Space Weather Technical Forecast

Issued on Saturday 19 October 2024 at 01:17 Local

This technical forecast provides a four-day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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Space Weather Forecast Headline: Isolated M-flares likely. Chance of G1 Minor Storm intervals days 3-4 (21-22 Oct).

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Activity has been Moderate with three M-class flares, all from AR3854, peaking with an M4.9 at 18/1938 UTC. There are nine sunspot regions currently on the disc, however only AR3856 in the northwest displays any notable complexity with a small delta spot within its intermediaries. AR3852 and AR3854 are now approaching the southwest limb, so difficult to assess. The other regions remain small and relatively simple with a number of these showing signs of decline.

No Earth-directed CMEs were observed.

Solar Wind / Geomagnetic Activity: Solar winds, as observed at L1 by ACE and DSCOVR, were generally at background to slightly elevated levels, ranging between 350-430 km/s. Density was around or below average. Interplanetary Magnetic Field (IMF), Bt, was Weak to Moderate between 5-13 nT, with its north-south component, Bz, turbulent, but just about favouring a negative orientation (southward) overall. This ranged between +9/-11 nT. Phi angle was generally positive (away from the Sun). Geomagnetic activity was Quiet to Active (Kp1-4).

Energetic Particles / Solar Radiation: High energy proton flux observed by GOES18 was at background. High energy electron flux (greater than 2MeV) observed by GOES16 saw a diurnal rise from Background to High, peaking at 1180 pfu at 18/1635 UTC. The associated 24-hour fluence was below the Active threshold. The 19/0000 UTC observation was 1.26e7 total pfu.

Four-Day Space Weather Forecast Summary

Solar Activity: Moderate activity is forecast with isolated M-class flares likely.

Solar Wind / Geomagnetic Activity: There are no Earth-directed CMEs. Background winds are most likely to persist, however spells of slightly elevated to elevated winds cannot be ruled out due to any interaction with the fast wind from CH80/+, which is likely passing north of Earth during days 1-2 (19-20 Oct). CH82/+ fast winds are then possible late day 3 (21 Oct) and into Day 4 (22 Oct). Mainly Quiet to Unsettled geomagnetic activity is expected. There is a chance of Active spells on days 1-2 (19-20 Oct) from any fast wind interaction from CH80/+, and chance of Active to G1 Minor Storm intervals days 3-4 (21-22 Oct) from the fast wind of CH82/+.

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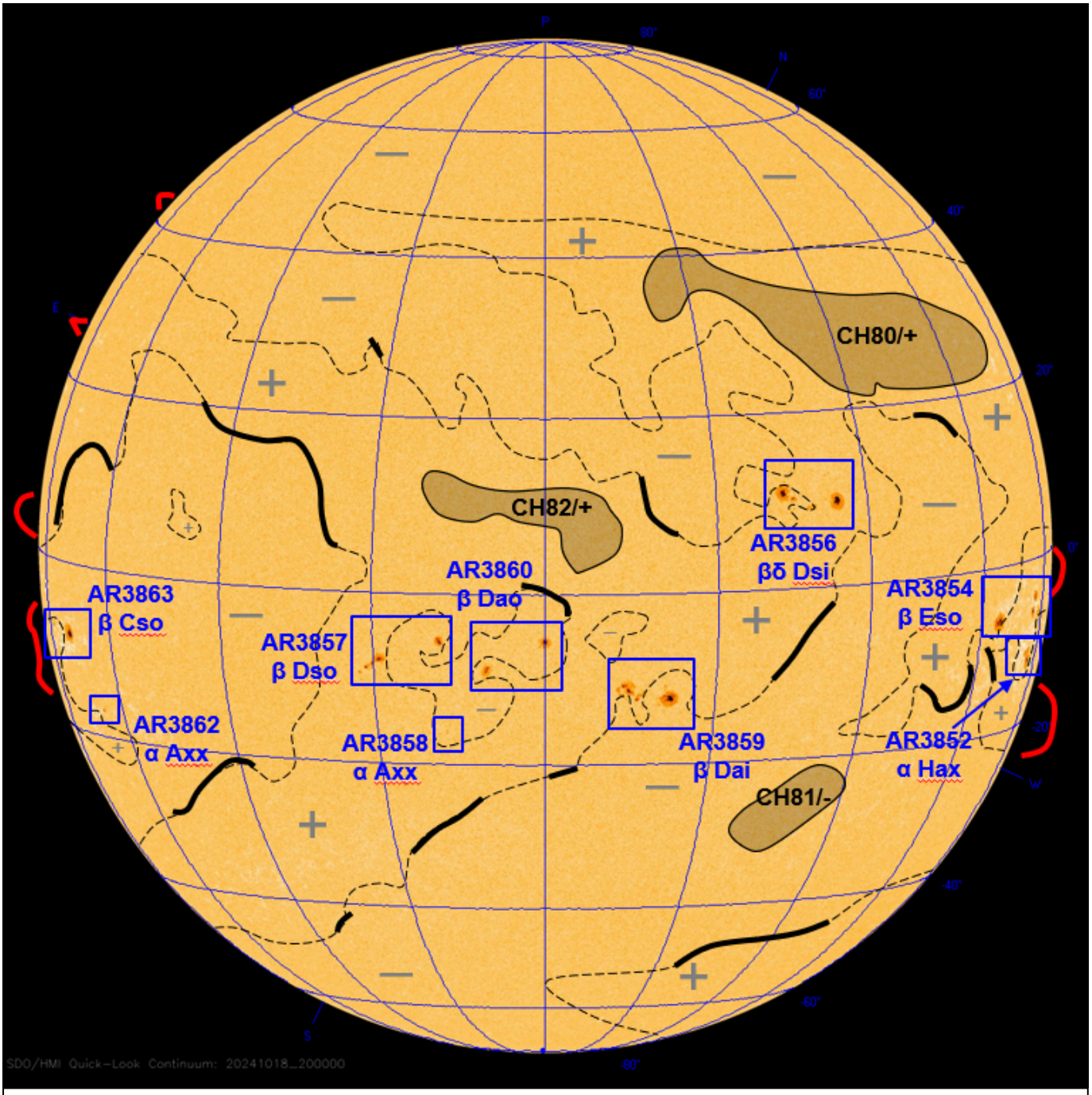
Energetic Particles / Solar Radiation: High energy proton flux at GOES18 is expected to remain at background. High energy electron flux at GOES-16 is forecast to remain Low to Moderate/High, with a chance of dropping out to more persistently Low given any fast wind onset, most likely days 3-4 (21-22 Oct). The associated 24 hour fluence is expected to remain below Active (1e8 total pfu).

Figure 1: Solar Synoptic Map valid 18/2000 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms

There are no Earth-directed CMEs.

Solar winds are currently at background, despite the large coronal hole currently located in the northwest disc. Given Earth's current location north of the elliptic plane, this was expected to give a broad enhancement of elevated winds that have not yet been observed. This now suggests that the core of the fast wind is likely passing north of Earth, however there remains a chance of moving into the southern edge of the winds from this feature for spells, giving brief periods of slightly elevated to elevated winds of around 450-500km/s through days 1-2 (19-20 Oct). This is supported by MOSWOC Enlil which shows the bulk of the winds from this feature passing north of Earth.

The next enhancement will then be from the onset of fast winds from CH82/+, which has its leading edge currently around 10W. This is a smaller, but more equatorial feature, with likely arrival for any CIR region expected to occur late on day 3 and into day 4 (21-22 Oct), with a period of elevated solar winds then expected to follow. This feature currently doesn't feature in Enlil, however on the previous rotation a G1 Minor Storm intervals was observed during the equivalent period.

Geomagnetic activity is forecast to be mainly Quiet to Unsettled. There is a chance of Active spells given any enhancement from CH80 days 1-2 (19-20 Oct). Fast wind onset from CH82 is then expected to bring Active to G1 Minor Storm intervals, perhaps on day 3 (21 Oct), but more likely on day 4 (22 Oct).

Geomagnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	10	5	20	30
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

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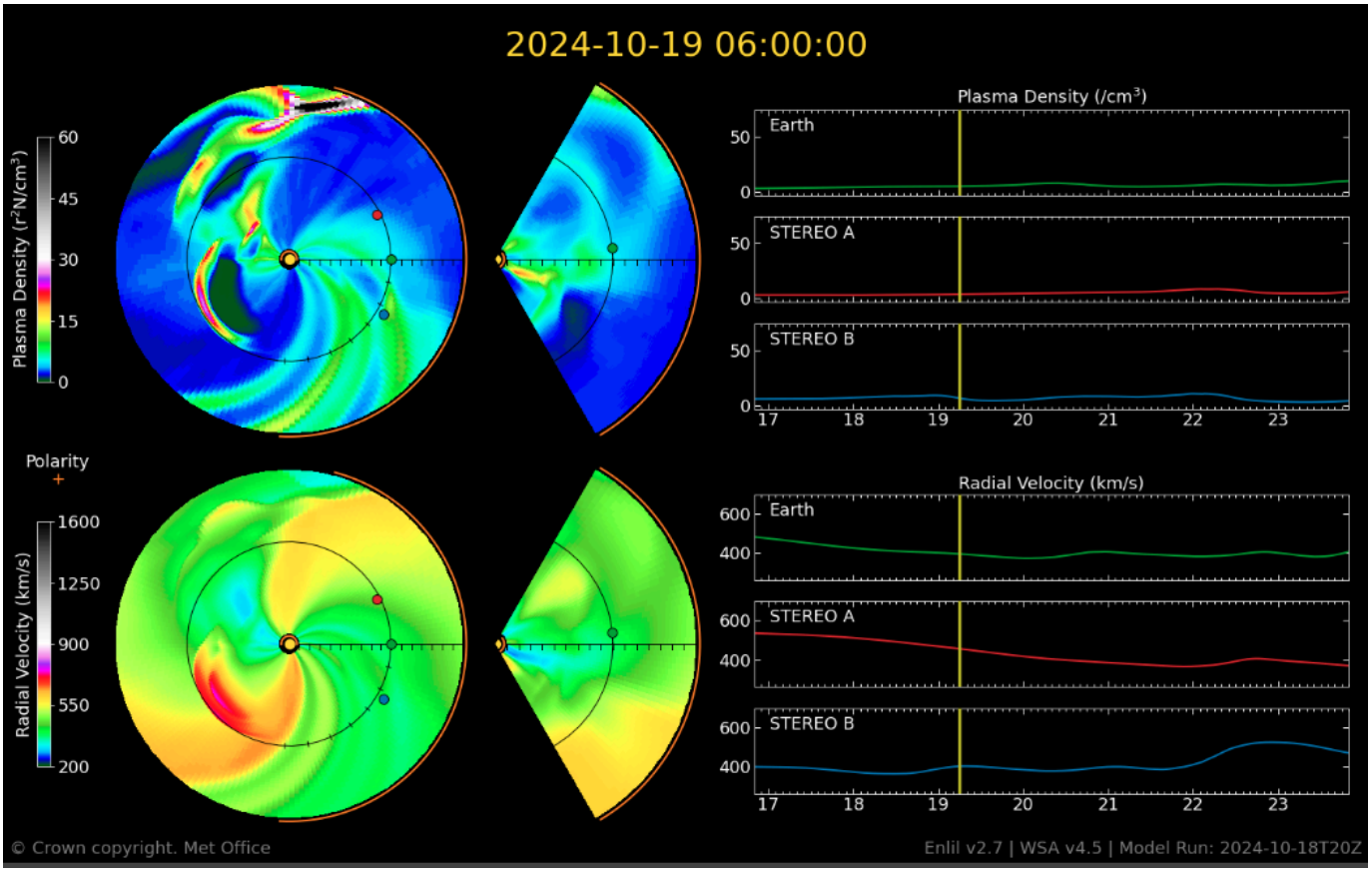
Figure 2: MOSWOC Enlil, showing bulk of CH80 fast wind passing to North of Earths orbit.



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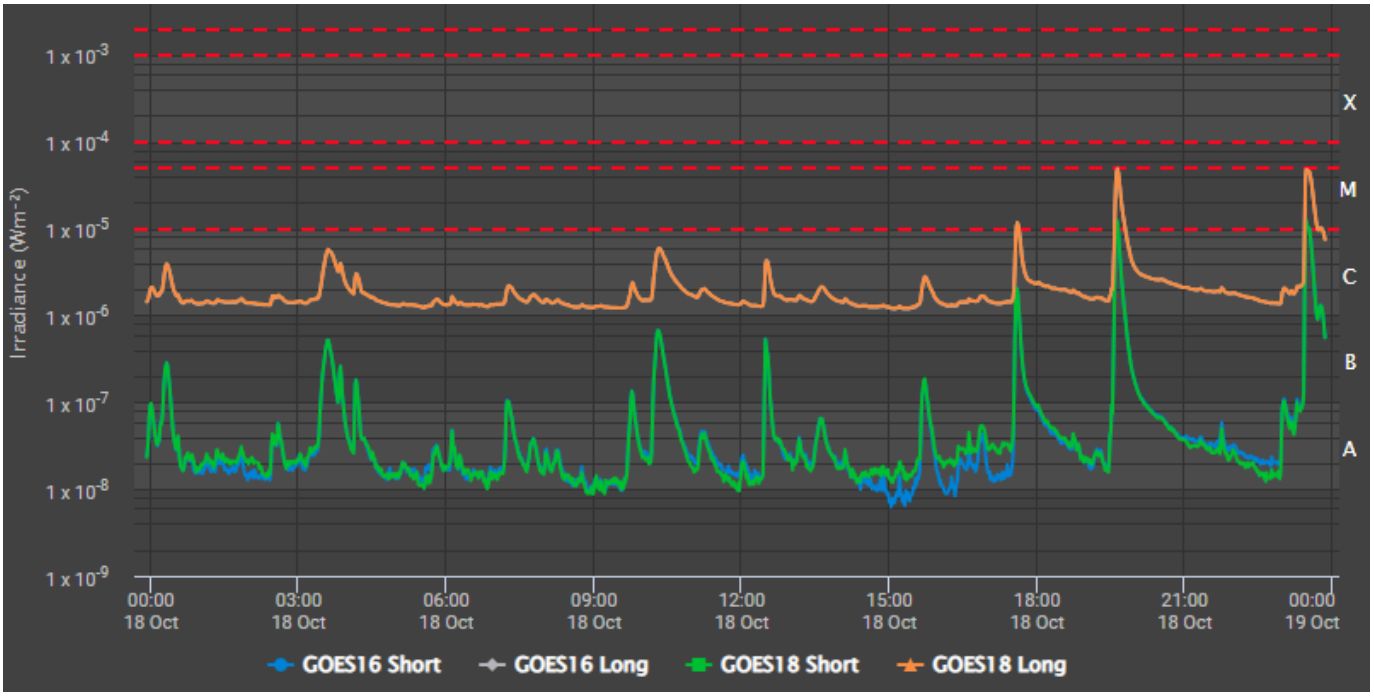
Radio Blackouts - X-Ray Flares

There are nine sunspot regions on the disc. These are all mostly relatively simple bipolar groups, with the only notable exception AR3856 in the northwest, which maintains a very small and weak delta spot within its intermediaries, but has been showing a weakening trend. AR3859 has now largely stabilised as a simple bipolar group. The other regions main across the south disc, AR3860 and AR3857, are also relatively small open bipolar regions. There are two newly numbered regions near the eastern limb, AR3863 now showing trailing spots and as such has been re-classified as a bipolar group, whilst the other, AR3862, is a small and simple unipolar spot currently. AR3852 and AR3854 continue to approach the west limb, and consequently are becoming harder to observe, with AR3854 starting to show more flare activity once again.

Solar activity is Moderate with three M-class flares in the past 24hrs, all from AR3854, peaking with a M4.9 at 18/1938 UTC. Moderate activity is expected, with isolated M-class flares likely, the risk declining slightly later in the forecast as AR3854 rotates around the western limb.

X-Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 (M Class)	Yes	60	60	50	50
Very Active	R3-R5 (X Class)	No	5	5	5	5

Figure 3: GOES-16 & -18 X-ray flux.



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Solar Radiation Storms (High Energy Protons)

High energy proton flux at GOES18 is expected to remain at background, with only a very slight chance of enhancement due to flare activity from any of the active regions currently on the disc, most likely those in the better connected western hemisphere.

Radiation Storms Probability (Exceedance)	Level ($cm^{-2}sr^{-1}s^{-1}$)	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	5	5	5	5
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and/or 50 MeV ≥ 10pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

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High Energy Electrons (≥ 2MeV)

High energy electron flux (greater than 2MeV) as observed by GOES-16 have been Background to Moderate. These flux values are expected to continue, perhaps dropping more persistently to background given any solar wind enhancement from the northern coronal hole fast wind on days 1-2 (19-20 Oct), or a more likely solar wind enhancement later on day 3 and 4 (21-22 Oct) from the central disc coronal hole CH82.

Overall, fluence is forecast to remain below Active with MOSWOC REFM currently providing good guidance.

GEO Electron Environment	Level ($cm^{-2}sr^{-1}$ day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ 2 MeV ≥ 1×10^{8}	No	1	1	1	1
Very Active	≥ 2 MeV ≥ 1×10^{9}	No	1	1	1	1

Figure 4: GOES-16 Electron flux.

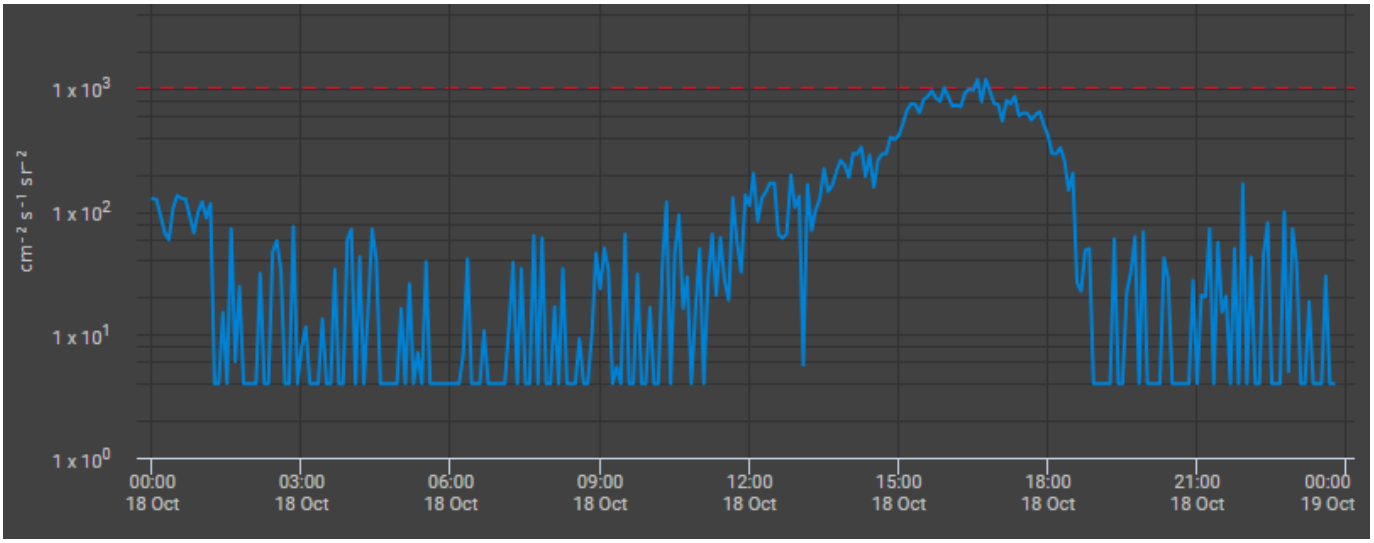

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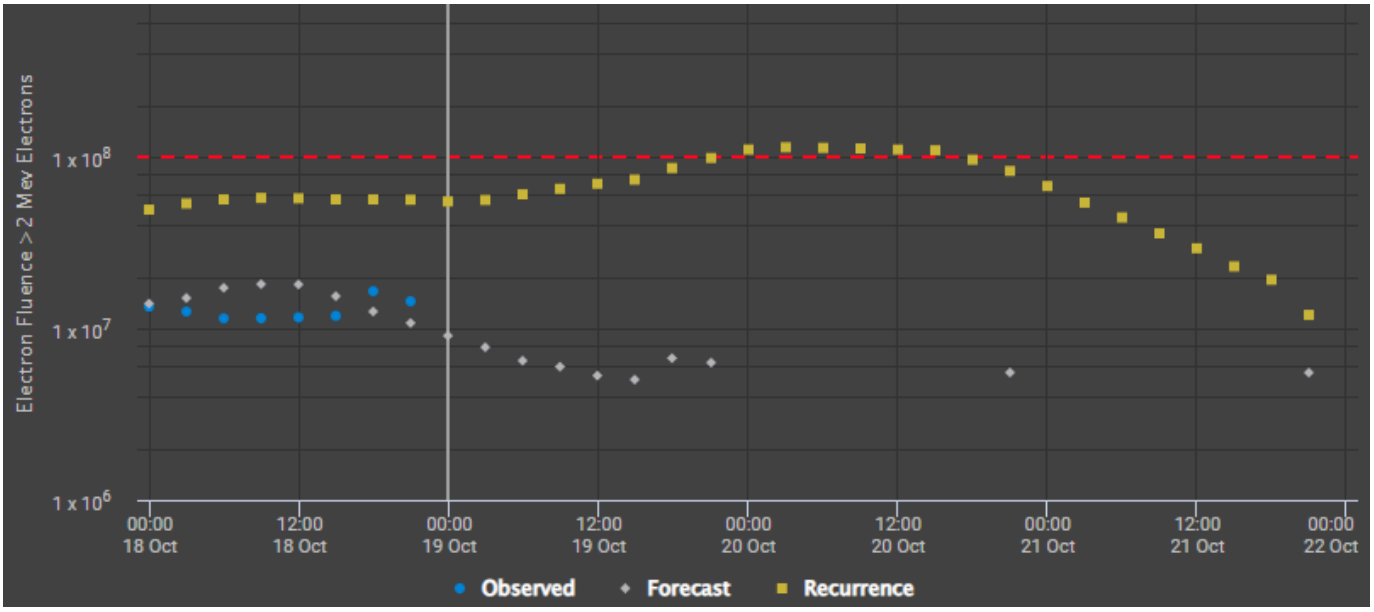
Figure 5: MOSWOC REFM.



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